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Synchronized video-review as a tool to enhance reflection and feedback: a design-based feasibility study

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Key words: Video, Audio-visual, training, surgical skills, Laparoscopic, reflection

Summary declaration of interest:

1. Northumbria Healthcare NHS foundation trust: Grant used to buy the laptop and the software used to process the audio-visual files.

Abstract

Introduction

UK Surgical training currently faces the challenge of expanding surgical skills in a context of reduced training opportunities. Video-review in theatre offers the potential to gain more from each learning opportunity and to enhance feedback.

Aim

This was a designed-based study to test the feasibility of using synchronised video-review as a reflective tool to enhance surgical training and to gain a deeper understanding of intraoperative feedback.

Method

Ten supervised laparoscopic cholecystectomy operations were video-recorded using a synchronised split-screen, to show trainees' actions, instrument manipulation and interactions with other theatre staff.

This was followed up by joint review of the operation-recording by both the trainee and supervisor. Video-review sessions were audio-recorded along with the consultant and SPR interviews after the review-session. Audio-recordings were thematically analysed. Supervisors completed the Procedure Based Assessments (PBA) forms, twice: post-operation and post-video-review. Forms were analysed to note any changes and to triangulate the findings.

Results

Overall trainee and supervisor feedback was positive. Trainees and supervisors reported the video-review added value in terms of reflection-on-action. It removed the stress of conducting/supervising the operation in real time and focussed the attention on feedback. Satisfaction was reported across trainee levels and with close and distant supervision style. Audio-visual review allowed trainees to understand the feedback better and to identify new targets beyond those gained from the verbal feedback during the procedure. It also facilitated appraisal of the trainer's teaching.

Discussion

This study established the feasibility of using synchronised video-review as a reflection-on-action tool to potentially enhance surgical training by improving feedback and enhancing each training opportunity. It identified trainees' difficulty in processing intraoperative feedback due to mental overload from the operation. It showed the limitations of current verbal feedback practice, using PBA forms, with regard to enhancing technical and non-technical skills due to denial and memory fading.

ACGME competency: Practice-Based Learning and Improvement

Introduction:

Surgical training in the UK is under great pressure due to the frequent introduction of new technologies such as laparoscopic and robotic surgery, and the reduction in available training time as a result of the implementation of the European Working Time Directive (EWTD). This reduction forces trainees to attain competency within a fifth of the previously recommended training time (1). As a result two-thirds of consultant surgeons have expressed concern over the suitability of qualified surgeons at the end of such shortened training programmes (2).

To respond to these current UK training challenges, the Intercollegiate Surgical Curriculum program was created as a competency based curriculum (3). It relies on using Procedure Based Assessment (PBA) forms as a formative assessment tool with a primary purpose of providing feedback as well as assessing trainees' skills during their supervised practice. The PBA is designed to be completed directly after observing the supervised procedure to prevent memory decay. Unfortunately, even in the ideal situation of post-observation completion of forms, missing or limited feedback has been identified (4). This finding was observed despite the possible Hawthorne effect (5) resulting from researchers' presence and direct observation suggesting poorer feedback in everyday practice. Failing to provide feedback is a major detriment to the value of formative assessment. It weakens the assumptions made about the benefits of using these formative assessment tools to enhance learning and creates dissatisfaction among users who were less convinced about the tool value (6).

Operative-video recording review was suggested as a tool to strengthen the assessment and improve the educational value of the operative experience, in the competency based curriculum era, by enhancing feedback and reflection (7).

Reflection is divided into two components: reflection-in-practice and reflection-on-practice (8). Reflection-in-practice represents the thinking process within the experience. It represents the mechanism to make step-by-step decisions while operating. Reflection-on-practice, on the other hand, is the step taken post-procedure to rethink the performed action and plan steps for future improvement. The latter is the important process to maximise the benefit of every training opportunity. Without such reflection, aided by coaching, training benefits would be severely diminished (9). Operative video-recording captures trainees' real performance in

theatre and reviewing trainees' own-recording would facilitating such reflection-on-practice (10, 11). Furthermore, there is clear evidence of video learning acceptance amongst trainees as a tool to improve their surgical knowledge (12).

Educational interests have shifted from the initial focus on using video assessment as a summative tool to trainee's video-review as a tool to enhance formative assessment (7). Such formative and reflective roles improve surgical training beyond traditional teaching (13). Evidence also supports the use of a synchronized intra-abdominal and external theatre views with audio recording to capture the full scope of trainees' performance (14).

New video-recording and synchronization systems, such as the Scotia Medical Observation and Training System (SMOTS) (15), have been introduced in many hospitals to aid clinical learning, but using them to conduct operative-coached video-reviews is expensive in terms of equipment and expert time. McQueen's recent review article showed the lack of understanding in the balance between the costs of using such tools and the benefit gained in the actual training environment (7). The majority of the current studies were carried using simple simulation tasks (16) rather than checking the improvement in the theatre environment with normal surgical procedures training. Furthermore, emerging evidence suggests a difference in feedback perception between trainees and trainers (17) highlighting the need to further investigate the benefit of surgical feedback within complex surgical practice.

Aims

This is a prospective design-based study which aimed to test the feasibility of using synchronised video-review as a formative assessment tool to support UK surgical training. As the design-based principles imply, video-review was used as a vehicle to gain deeper understanding about the role of feedback and reflection in the current UK surgical training environment.

Methods

This study was conducted as part of a PhD in medical education, using design-based research (18). Ethical approval for the research was granted by Durham University's Research Ethics Committee, NHS information governance and finally by the NHS Research Ethics Committee.

Patients were approached after being identified as potential training cases by the supervising consultants. Consultants usually make such decisions based on their knowledge of a trainee's capability and the complexity of the case judged by patient body habitus, the ultrasound scan report and time pressure on the operation day. The consultant or the surgical trainee introduced the researcher to the patient and the patient received an explanation about the research along with an information sheet and consent form. None of the approached patients declined to take part in the research or withdrew participation.

Ten supervised laparoscopic cholecystectomy operations were recorded in eight hospitals in the Northern region. Surgical trainees were invited to join the study with the mutual approval of their supervisors to jointly review the video-record of their supervised operation.

The research aimed to film the supervised laparoscopic cholecystectomy operation in a synchronised way to record the laparoscopic field inside the abdomen and the overall surgical environment within theatre. The resulting video showing trainees' actions and instrument manipulations as well as trainees' interactions with the staff. The external field (trainee/trainer view) was audio-visually recorded with a dedicated high definition digital camera and the intra-abdominal view was extracted via USB memory stick from the video-recording machine in the laparoscopic stack. The two video files were synchronised and merged into one file using Adobe Premiere Pro CS6 software.

The synchronised video was then reviewed by the supervising consultant and the operating trainee. Semi-structured interviews were conducted post video-review with the trainee and trainer separately, if feasible, on a face to face basis, to facilitate greater insight into candidates' experience with the review session and the feedback practice. The video-review session and the following interviews were audio-recorded, professionally transcribed and thematically analysed following the six phases described by Braun and Clark (19). Content thematic analysis was conducted by SI, and the codes and themes were discussed by the research team. This analytical approach produced themes which reflected the evaluative aims of the research (theory-driven); as well as themes that emerged from the data (data-driven).

The PBA form was completed by the supervising consultant twice; after the operation and following the video-review to compare the results and triangulate the findings.

Results and discussion

The ten recruited surgical trainees were three females and seven males, while the supervising consultants included two females and eight males. Trainees' level ranged from a first year Speciality trainee ST3 to final year ST8. Consultants' and trainees' sub-speciality interests were a mix of benign upper gastrointestinal, bariatric, colorectal and breast surgery but they all performed and supervised laparoscopic cholecystectomy operations as part of their routine practice.

PBA form results

The main aim of surgical training is to prepare the trainees to become consultants and be capable of operating independently. To achieve this aim, supervising consultants usually assess their trainees' competency and alter their supervision style accordingly. Supervisors may scrub and hold the camera for some candidates, providing close instruction and guidance. They might also be present un-scrubbed in theatre to observe part of the operation or leave trainees to operate alone and call for help if needed. As the research aimed to test the feasibility of using video-review in daily surgical practice supervisors were left to follow their own style. The result was an equal division between scrubbing (Case 1,3,5,6,7) and distant supervision (Case 2,4,8,8,10).

The majority of the post-operative PBA paper forms were handed back to the researcher, with missing or very minimal feedback in the comment section (8/9). This was in line with the Sheffield research group findings (4). Such feedback is highly valued by trainees as it addresses their individual needs (16, 20).

PBA has six general assessment domains with feedback spaces for consultants to give constructive feedback to their trainees and a global assessment part (Appendix 1). The global assessment has four competency levels, which range from 1 'novice' to a 4 'fully competent surgeon' (21).

Most PBA forms, both post-operations and post video-review sessions, were conducted on paper forms. However, three surgical trainees completed the post-operative PBA online, as part of their training portfolio using the Intercollegiate Surgical Curriculum Program (ISCP) online forms. Two of these candidates later

emailed a copy of the PBA leaving a missing post-operative PBA (case 5). Another post-operation PBA assessment was missed (case 8) due to the consultant's busy schedule on the operation day and annual leave in the days following the procedure. The post video-review PBA form was also missed for (case 6) as the consultant was called for an emergency. As a result, the number of paired assessments was reduced to seven.

The PBA global summary remained the same in both post operation and post video-review forms at level 3 in two cases (case 3, 4) and at level 4 in three cases (cases 2, 9, 10). It changed from 3 in the post operation form to 4 in post video-review forms (case 1) and from 2 to 3 (case 7). Supervising consultants were scrubbed in both of those cases and helped in the operation. These assessment changes made by the supervisor could indicate that they, as well as trainees, experience mental overload during the operation and this impedes their ability to fully assess the trainee's competency. The assessment of trainees may be especially challenging due to their frequent rotation, and the loss of the old team-based training, where the team was stable. This meant that the team members were known to each other and knowledge of trainee skills and their ability was established over time.

Synchronised video review value as a reflection tool

Candidates reported that the synchronised view added value in capturing technical skills, and ergonomics as well as non-technical aspects. Some even argued that the synchronised video was the only difference in this research, as the non-synchronised intra-abdominal view was the standard recording option which is easily obtained by the press of a button in laparoscopic surgical instrument if needed.

> *"I like the fact that you can see the Trainee and the Trainer standing and how they interact, human factors, body language. Interaction with other staff ... you don't necessarily hear, for example, if it was just audio, or if you were just looking at the Laparoscopic image ..."*
> (Consultant, case 7)

Video-review provided the opportunity to conduct reflection-on-practice and generate an improvement agenda. The review was carried out in a stress-free environment, without the additional burden of performing the procedure. A stress-free environment reduces the mental overload which inhibits

understanding simultaneous feedback during the operation, as trainees (SPRs = Specialist Registrars) struggle to split their attention between operating and hearing, responding and comprehending the feedback all at the same time.

> *"If you're getting feedback during the operation you're often not listening to it because you're too busy concentrating on what you're doing to take it on board and act on it. Whereas now, I feel a bit better saying 'you were safe with the Hook ...."* (SPR, case 3)

A stress-free environment in which to provide feedback was also appreciated by the supervising consultants. Supervisors have multiple roles in theatre: they have to train the SPR and provide feedback while ensuring patient safety and interacting with various team members in theatre. Giving feedback during the video-review session removed all other cognitive demands and focussed attention on feedback alone.

> "*I think I gave the SPR some feedback about this procedure at the time … but having the recording really helps you to look at things again without also being consumed by doing the operation so … I think it's a very useful for feedback."* (Consultant scrubbed, case 3)

The ability to reduce mental burden and focus entirely on the assessment led to improvements in PBA scoring in case 1 and 7. Improved insight into trainee's action was also reported in the cases where the PBA assessment did not change, even in the un-scrubbed supervisors, who should theoretically have been more distant from the operation, so less consumed mentally than scrubbed supervisors.

> *"I think you probably do see more than you do when you're doing a procedure. I think you're more aware because you're not concentrating on anything else, you're just focusing on the video."* (Consultant un-scrubbed, case 8)

In his review article, McQueen argued that such stress-free environments offer the potential for the trainers to capture more minor details about trainees abilities that might be missed during live operations (7). This

might encourage trust which could be translated into dedicating further training opportunities to their trainees and tailor training more to trainees needs.

> *"Interesting, based on what I've seen now, what we need to do with this particular Trainee is just do more difficult ones, more acute one where there's more decision making."* (Consultant un-scrubbed, case 2)

Such emphasis on the individual specific training needs represents a golden opportunity to specify and address targeted weakness (7). This could provide a great opportunity to accelerate training and reduce the time needed to reach competency.

Valuable performance feedback

Video-review also provided trainees with objective feedback on their performance. Gaining such an objective view on reality helped to generate a self-improvement agenda which was more likely to be identified and implemented, rather than receiving supervisor feedback, which could be more readily denied and ignored (22). Some surgical trainees had previously received feedback about certain skills but they did not feel the need to take any corrective actions until reviewing their videos.

> *"There is loads of things I picked up from the video review that I would like to change, simple things, like talking to your assistant more, keep engaging the team. Bosses have told me to get more involved with the assistant and I was feeling comfortable that I was doing as much as I needed, but looking at it as a third person, seeing me do it, I felt I was very quiet, I like to keep the team engaged and get their opinions..."* (SPR, case 2)

Case 4 highlighted the potential of the video-review to facilitate deeper feedback understanding. Before starting the video-review session, and upon the consultant request, the trainee recalled the operation feedback and main learning points. However, during the video review, the trainee started to put those comments into context and critically analyse the performed action with clear improvement plans for the future.

"The insight it gives you into things, It is very revealing in a way that makes you think. I adjust my position just to think that I'll get better tension but actually even after adjusting I still haven't got good tension and I dissect. It's probably better than before but I can see from the picture that it could have been better and you don't realise that when you're operating. It's a powerful tool to look at." (SPR, Case 4)

Candidates suggested that video-review could potentially improve and enhance feedback, such that it could even condense training and overcoming the reduction in the training time.

"EWTD restricting the number of hours, [there's] not enough hours to do Lap Choly, that'll be a very useful way of coming up with the competence. We can target certain operations, index procedures." (Consultant un-scrubbed, case 10)

"The efficiency and competency, is better achieved by watching yourself, to reflect. I think it should be done in every major operation at least once or twice." (SPR, case 8)

<u>Teaching appraisal</u>

Video-review sessions also presented an opportunity for the consultants to reflect on their teaching style. They could see and hear the instructions they had provided to trainees and reflect on it.

"I think maybe I need to be more explicit, or reflect on how explicit I am in my verbal instruction" (Consultant, case 5)

Candidates also thought that video-review sessions were a good way for educational supervisors to provide evidence about their teaching quality. Such evidence might be required in the future for educational supervisors' teaching/educational appraisals.

"I think it's got a lot of opportunities for both reflection and evaluation really, and I think increasingly, if we're going to be Educational Supervisors or Trainers we're going to have to probably provide more and more evidence." (Consultant, case 1)

Comparing Video-review to PBA

Candidates appreciated the superior feedback value of the video-review session over traditional feedback using PBA form. They argued that memory fading reduced both the accuracy and value of feedback unless the PBA was done directly after the procedure. Such immediate feedback using the PBA is challenging in the rushed clinical practice. This resulted in the erosion of trust in the PBA feedback value as a learning tool.

"PBA is meant to be a learning tool but I think it's often used more for proof of competence by deaneries now rather as using them as a learning tool for the Trainee… It is the paperwork for the ARCP" (SPR, case 10)

"It's just a sheet of paper with tick boxes and it really doesn't help... the whole learning is involved in the feedback, the actual feedback that you give to the Trainee. That's where the benefit is, and this is quite like that obviously… because you are watching a procedure together." (Consultant, case 7)

Limited trust in the educational value of the PBA was evident among candidates in this study. Such a finding might explain the limited feedback provided in the PBA despite direct observation in the Sheffield research group study (4). However, those views cannot be generalised as this is a feasibility study using a small sample size and it could have suffered from a selection bias of educationally enthusiastic candidates. However, it corresponds with reported criticism in the literature (6). Further studies are needed to explore views more widely from the surgical community on the educational value of PBA forms.

Time restraint

Despite the reported value of the video-review in enhancing surgical training in both technical and non-technical skills, video-review is time consuming. It required the consultant to find a time in his/her schedule and review the recording with the trainee. Nonetheless, candidates were overwhelming supportive of future video-reviews as long as they were carried out within a reasonable range of one to two reviews per rotation. They argued that it was a powerful feedback tool and should be used selectively to target certain skills and check progress in the rotation.

> *"Concern is time inevitably for the video playback, but it's something you could do maybe two or three times on a six-month attachment for this particular one key operation."* (Consultant un-scrubbed, case 4)

To overcome time limitations, candidates suggested adding the video-review time to the educational supervisor's job description and reserving a session as a protected teaching time to conduct such activities.

> *"It's effectively going to absorb half a session. So, it does have to come in my admin on SPA time but I think as long as that's recognized in job planning, and we see it as a quality tool, and I think it is useful to reflect on your own teaching, Training."* (Consultant, case 5)

The need to incorporate a dedicated educational time to carry such video-review was also highlighted in McQueen's review article (7).

Conclusion

This study indicates the feasibility of using synchronised video-review to enhance surgical training in the UK. Synchronised video-review works as a practical tool to facilitate trainees' reflection on the technical and non-technical aspect of their performance. This tool was appreciated by trainees of all levels and showed potential for use with both scrubbed and distance supervision styles. It replays the feedback and action in a stress-free environment away from the pressure of performing the procedure. Such pressure creates a mental overload restricting the surgical trainee's ability to understand, process

and implement the feedback given during the operation, as was evident by candidates' interview comments and supported by the literature (7).

Mental overload also affects the consultants' ability to provide clear verbal feedback in theatre. This was evident in consultants' comments on their training style. It has been echoed in the literature by discrepancies in what was perceived as feedback, while watching a video-recording, with trainers reporting more interactions as feedback compared to trainees (17). The majority of trainers' intraoperative guidance was also reported to be instructions rather than feedback (23). This is not surprising as intraoperative feedback represents reflection-in-practice which is a step-by-step decisions to progress the operation (8). Reducing mental overload could have contributed to the improvement in the PBA global assessment grading in two cases after the video-review session and shows the benefit of revisiting assessments in a stress-free environment.

Video-review gave the consultants an improved way to check trainees' competency and identify their learning needs providing the opportunity to build up trust and tailor future training opportunity to individual trainees' needs. This tailored training should support trainees to achieve the required competencies in a reduced time frame and offer trainers the opportunity to reflect on their teaching skills.

Furthermore, reviewing trainees' own-video-recordings provides an objective reality check to overcome memory decay and denial. This allows trainees to detect their own-mistakes and better process the reason behind the received feedback. This helps to create an internal correction agenda which will be better followed, rather than an external supervisor enforced agenda. As a result, reviewing trainees' own-operations using synchronised video-recording could potentially enhance the utility of available training opportunities and shorten the time needed to reach competency (13). This is vitally important in the current era of competency based curriculum.

Candidates favoured the video-review feedback over the standard verbal feedback using PBA, as a formative assessment tool to enhance reflection and feedback. They expressed concern over the PBA ability to provide the necessary feedback due to difficulty in timely form-filling post-procedure and memory fading effect in retrospective form filling practice. However, despite similar criticism in the

literature (6), further study is needed to explore the views of the wider surgical community about the educational value of PBA when compared to deeper audio-visual reflective exercises.

Study limitation

This is a pilot study of ten operations to check the feasibility of conducting synchronised video-review in the UK surgical training environment. The results presented highlight feasibility, using small sample and may be subject to a level of selection bias from educationally enthusiastic candidates due to their voluntary participation. The study was limited to one deanery in England and ten paired trainee-trainers. The researcher used a camera to record the outside theatre view and a video-processing software to synchronise it with the intra-abdominal view to overcome the limited availability of digital theatres and the cost of commercial synchronization systems (15) in the NHS. However digital theatres are becoming a standard feature of newly built or renovated theatres and the commercial synchronised recording systems are increasingly adopted in various educational activities in the NHS. The study result could support further utilization of those systems in surgical training and provides the basis for future study to explore the possibility of wider implementing those systems in the UK surgical training curriculum.

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